

Amendment under 37 CFR 1.111
Serial No. 10/654,974
Attorney Docket No. 031063

AMENDMENTS TO THE CLAIMS:

This listing of claims replaces all prior versions and listings of claims in the application.

Listing of claims:

Claim 1 (Original): A frequency measuring circuit comprising:
a first counter which counts reference clocks during one cycle of a signal to be measured or a period which is integer times as long as the one cycle, a time difference detection circuit which detects time difference between the signal to be measured and the reference clock, a time expansion circuit which expands an output pulse width of the time difference detection circuit by a given magnification, and a second counter which counts the reference clocks during the pulse width which is expanded by the time expansion circuit, wherein

the frequency of the signal to be measured is obtained based on count values of the first and second counters.

Claim 2 (Original): A frequency measuring circuit according to claim 1, wherein the count value of the second counter is divided by the given magnification with which the time expansion circuit expands the pulse width, and a result of the division is added to

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the count value of the first counter so as to obtain the frequency of the signal to be measured.

Claim 3 (Original): A frequency measuring circuit according to claim 1 or claim 2, wherein the time difference detection circuit outputs a pulse signal having the pulse width from a point of time that a level of the signal to be measured is changed to a point of time that a level of the reference clock is changed.

Claim 4 (Previously Presented): A frequency measuring circuit according to claim 1 or claim 2, wherein the time expansion circuit includes a first time constant circuit which is charged with a given voltage, a second time constant circuit which has a time constant larger than a time constant of the first time constant circuit and is charged with a given voltage, a comparator which compares output voltages of the first and second time constant circuits, and a gate circuit to which an output of the comparator and a signal relevant to a start signal are inputted and which outputs a signal relevant to an output of the comparator during a pulse width of the signal relevant to the start signal, wherein a charge stored in the first time constant circuit during the output pulse width of the time difference detection circuit is discharged, and a charge stored in the second time constant circuit during the pulse width of the start signal is discharged.

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Claim 5 (Previously Presented): A frequency measuring circuit according to claim 1 or claim 2, wherein the time expansion circuit includes a first voltage dividing circuit and a second voltage dividing circuit which are arranged between a fixed power source voltage and a common potential point, an operational amplifier which connects a voltage dividing point of the first voltage dividing circuit with an inverted input terminal and connects a voltage dividing point of the second voltage dividing circuit to a non-inverted input terminal as a fixed threshold voltage thus forming an integrator, and a comparator which connects an output of the operational amplifier with an inverted input terminal and connects a voltage dividing point of the second voltage dividing circuit to a non-inverted input terminal as a fixed threshold voltage, wherein a charge stored in a capacitor in the inside of the integrator is discharged in response to inputting of the time difference signal.

Claim 6 (Previously presented): A resonant pressure sensor type differential pressure/pressure transmitter comprising:

a first counter which counts reference clocks during one cycle of a resonant pressure sensor or a period which is integer times as long as the one cycle, a time difference detection circuit which detects time difference between the signal to be measured and the reference clock, a time expansion circuit which expands an output pulse

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width of the time difference detection circuit by a given magnification, and a second counter which counts the reference clocks during the pulse width which is expanded by the time difference expansion circuit, wherein

the frequency of the signal to be measured is obtained based on count values of the first and second counters, and pressure is obtained based on the frequency.

Claim 7 (Original): A resonant pressure sensor type differential pressure/pressure transmitter according to claim 6, wherein the count value of the second counter is divided by the given magnification with which the time expansion circuit expands the pulse width, and a result of the division is added to the count value of the first counter so as to obtain the frequency of the signal to be measured.

Claim 8 (Original): A resonant pressure sensor type differential pressure/pressure transmitter according to claim 6 or claim 7, wherein the time difference detection circuit outputs a pulse signal having the pulse width from a point of time that a level of the signal to be measured is changed to a point of time that a level of the reference clock is changed.

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Claim 9 (Previously Presented): A resonant pressure sensor type differential pressure/pressure transmitter according to claim 6 or claim 7, wherein the time expansion circuit includes a first time constant circuit which is charged with a given voltage, a second time constant circuit which has a time constant larger than a time constant of the first time constant circuit and is charged with a given voltage, a comparator which compares output voltages of the first and second time constant circuits, and a gate circuit to which an output of the comparator and a signal relevant to a start signal are inputted and which outputs a signal relevant to an output of the comparator during a pulse width of the signal relevant to the start signal, wherein a charge stored in the first time constant circuit during the output pulse width of the time difference detection circuit is discharged, and a charge stored in the second time constant circuit during the pulse width of the start signal is discharged.

Claim 10 (Previously Presented): A resonant pressure sensor type differential pressure/pressure transmitter according to claim 6 or claim 7, wherein the time expansion circuit includes a first voltage dividing circuit and a second voltage dividing circuit which are arranged between a fixed power source voltage and a common potential point, an operational amplifier which connects a voltage dividing point of the first voltage dividing circuit with an inverted input terminal and connects a voltage dividing point of the second

voltage dividing circuit to a non-inverted input terminal as a fixed threshold voltage thus forming an integrator, and a comparator which connects an output of the operational amplifier with an inverted input terminal and connects a voltage dividing point of the second voltage dividing circuit to a non-inverted input terminal as a fixed threshold voltage, wherein a charge stored in a capacitor in the inside of the integrator is discharged in response to inputting of the time difference signal.

Claim 11 (New): A frequency measuring circuit according to claim 1 or claim 2, wherein the time expansion circuit includes a first buffer which receives a start signal, a first diode connected to an output terminal of the first buffer, a second buffer which receives an output from the time difference detection circuit, a second diode connected to an output terminal of the second buffer, a first time constant circuit which is charged with a given voltage, a second time constant circuit which has a time constant larger than a time constant of the first time constant circuit and is charged with a given voltage, a comparator which compares output voltages of the first and second time constant circuits, a first switch having one end connected to a reference voltage and another end connected to an inverted input terminal of the comparator, a second switch having one end connected to the reference voltage and another end connected to a non-inverted input terminal of the comparator, and a gate circuit to which an output of the comparator and a

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signal relevant to the start signal are inputted and which outputs a signal relevant to an output of the comparator during a pulse width of the signal relevant to the start signal, wherein a charge stored in the first time constant circuit during the output pulse width of the time difference detection circuit is discharged, and a charge stored in the second time constant circuit during the pulse width of the start signal is discharged.

Claim 12 (New): A resonant pressure sensor type differential pressure/pressure transmitter according to claim 6 or claim 7, wherein the time expansion circuit includes a first buffer which receives a start signal, a first diode connected to an output terminal of the first buffer, a second buffer which receives an output from the time difference detection circuit, a second diode connected to an output terminal of the second buffer, a first time constant circuit which is charged with a given voltage, a second time constant circuit which has a time constant larger than a time constant of the first time constant circuit and is charged with a given voltage, a comparator which compares output voltages of the first and second time constant circuits, a first switch having one end connected to a reference voltage and another end connected to an inverted input terminal of the comparator, a second switch having one end connected to the reference voltage and another end connected to a non-inverted input terminal of the comparator, and a gate circuit to which an output of the comparator and a signal relevant to the start signal are

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inputted and which outputs a signal relevant to an output of the comparator during a pulse width of the signal relevant to the start signal, wherein a charge stored in the first time constant circuit during the output pulse width of the time difference detection circuit is discharged, and a charge stored in the second time constant circuit during the pulse width of the start signal is discharged.

Claim 13 (New): A frequency measuring circuit according to claim 1 or claim 2, wherein the time expansion circuit includes a first voltage dividing circuit and a second voltage dividing circuit which are arranged between a fixed power source voltage and a common potential point, an operational amplifier which connects a voltage dividing point of the first voltage dividing circuit with an inverted input terminal and connects a voltage dividing point of the second voltage dividing circuit to a non-inverted input terminal as a fixed threshold voltage thus forming an integrator, a comparator which connects an output of the operational amplifier with an inverted input terminal and connects a voltage dividing point of the second voltage dividing circuit to a non-inverted input terminal as a fixed threshold voltage, a capacitor connected between the inverted input terminal and the output terminal of the operational amplifier, and a series circuit including first and second fixed voltage diodes connected in parallel with the capacitor,

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wherein a charge stored in a capacitor in the inside of the integrator is discharged in response to inputting of the time difference signal.

Claim 14 (New): A resonant pressure sensor type differential pressure/pressure transmitter according to claim 6 or claim 7, wherein the time expansion circuit includes a first voltage dividing circuit and a second voltage dividing circuit which are arranged between a fixed power source voltage and a common potential point, an operational amplifier which connects a voltage dividing point of the first voltage dividing circuit with an inverted input terminal and connects a voltage dividing point of the second voltage dividing circuit to a non-inverted input terminal as a fixed threshold voltage thus forming an integrator, a comparator which connects an output of the operational amplifier with an inverted input terminal and connects a voltage dividing point of the second voltage dividing circuit to a non-inverted input terminal as a fixed threshold voltage, a capacitor connected between the inverted input terminal and the output terminal of the operational amplifier, and a series circuit including first and second fixed voltage diodes connected in parallel with the capacitor,

wherein a charge stored in a capacitor in the inside of the integrator is discharged in response to inputting of the time difference signal.